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AEROPHYSICS DEPARTMENT

October 10, 1966

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Huntsville, Alabama 35812

Subject: Progress Report for the Month of September 1966
Contract No. NAS8-20383

1. The research conducted during this period was performed under NASA Contract No. NAS8-20383.

2. Photographic techniques that can be used to determine the mean velocity of particles in turbulent flow have been progressing in a small-scale demonstration water tunnel. Camera shutter speeds and stop numbers were calculated and used to measure the velocity in the water tunnel. Pictures of the laminar flow were taken for comparison with the turbulent case and a few preliminary experimental turbulent flows were photographed. Various types of particles were used in an attempt to determine the best material for flow visualization in the small water tunnel. Aluminum particles proved easiest to photograph but gave rise to gravitational errors because of their density. Polystyrene beads with the same specific gravity as water were also used, but were found hard to photograph due to their size being approximately the same as air bubbles in the tank. The polystyrene beads now have been dyed black and should be more visible when photographed against a white background.

   A narrow slit of light has proved to give the best illumination since only a few particles need to be photographed. This technique eliminates superfluous particles which would otherwise appear in the photographs.

3. The pipe facility in which the hot-wire anemometer experiments in water are to be performed is under construction. This facility is 50 feet long and 5 feet high and is being driven by a jet pump in the bottom corner. In order to achieve the desired Reynolds number and simultaneously minimize the dynamic pressure encountered by the relatively delicate hot-wire sensors, a 4-inch inside diameter pipe was selected. This diameter yields a mean dynamic pressure of approximately 16 pounds per square foot, and at the same time, provides a vehicle for adequate spatial resolution of probe locations along the radius. A closed-loop configuration was dictated by the

need to conserve water, since distilled water is necessary to minimize any electro-chemical effects. An inlet length of approximately 48 feet, i.e., 144 diameters, into the test section should provide ample distance for any secondary flows due to pump or turns to be damped out and fully developed turbulence to be present in the test section..

Since interior wall scaling and electrical wall effects were considered possible with metal pipes and undesirable, polyvinylchloride (PVC) was chosen as the pipe material. This is the same type of pipe being used in many water systems due to its durability and the ease with which it can be connected.

The test section is planned to be a Plexiglas tube two feet long with the same inside diameter as the PVC. The joint between the two pipes will be smoothed down so that any irregularities will be confined to the laminar sublayer. Plexiglas was chosen to aid in probe orientation and inspection; however, at this time, the Plexiglas has not been delivered, although delivery has been promised in the near future.

It is planned in the coming months to have the pipe facility in working order and to proceed with the instrumentation of the test section and calibration of the test equipment in the flow under consideration. Once this is done, mean velocity profiles across the pipe will be calculated to provide a means of reducing the fluctuating velocity components to absolute quantities, since they are first obtained as fractions of the mean velocity at the point of measurement. Completion of this phase will then clear avenues for calculating the turbulence levels and correlation coefficients.

Sincerely,

Seán C. Roberts

Seán C. Roberts, Head
Aerophysics Department

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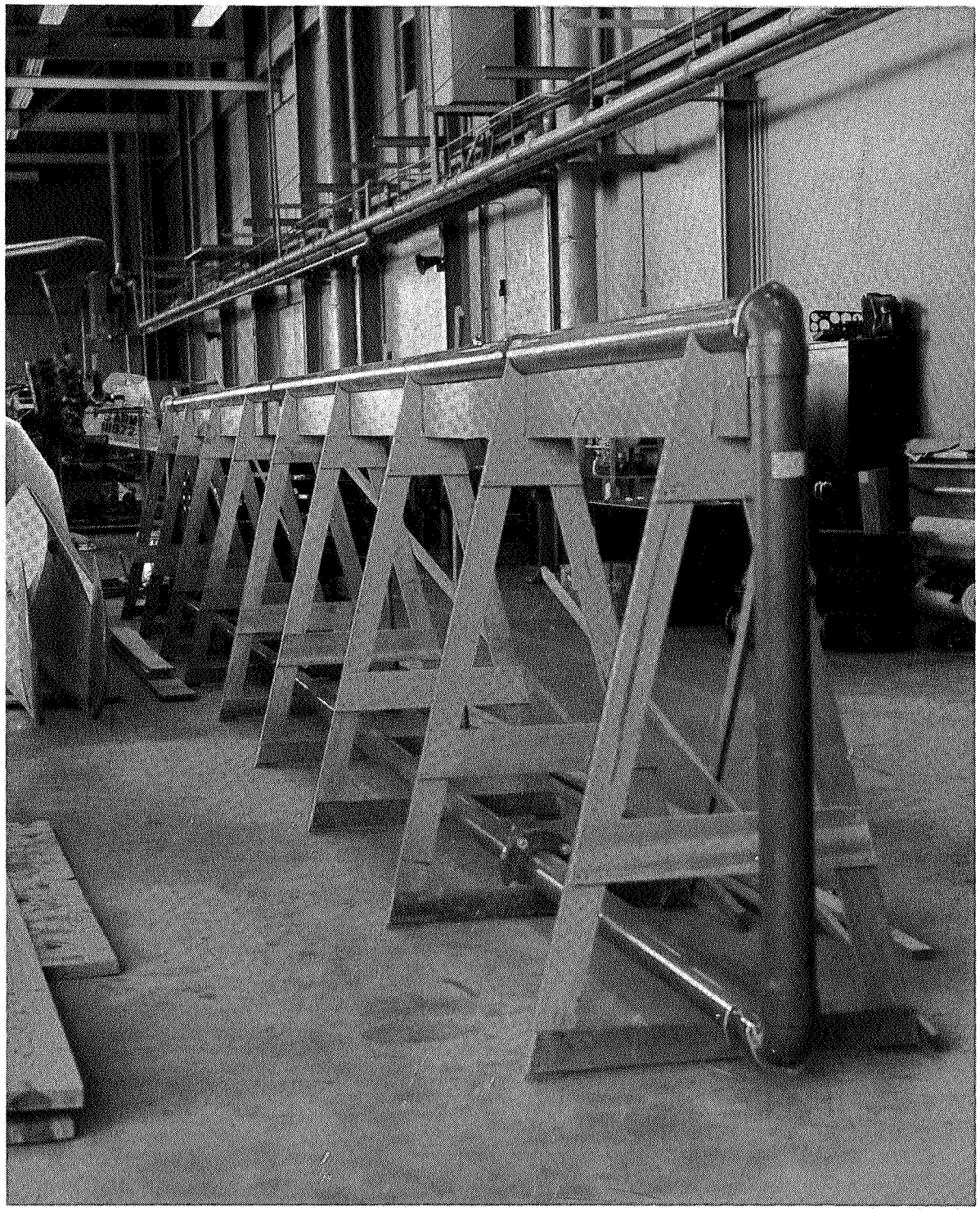

Figure 1. Overall View of Pipe and Support.

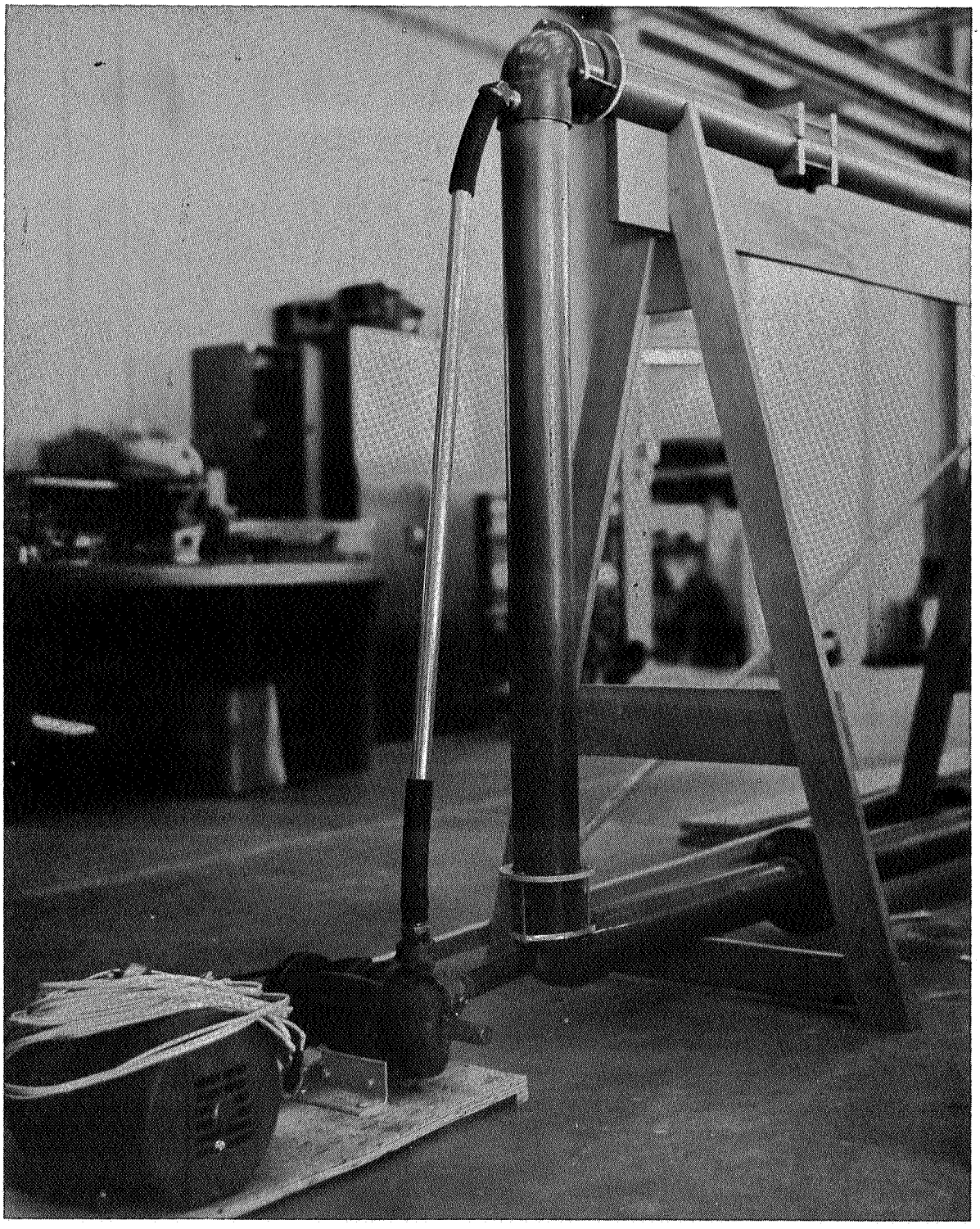

Figure 2. Jet Pump Installation in Pipe Circuit.

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